

#### ABSTRACT OF THE DISCLOSURE

A fine vacuum tube element and other electronic elements are integrated and formed on a semiconductor substrate, and the fine vacuum tube element and the other electronic elements transmit signals to and from each other. When integrating the vacuum tube element with the other electronic elements, a quantum effect is realized in a room temperature environment by utilizing ballistic electrons (non-scattering electrons) traveling through the vacuum, and in the integrated circuit, an A/D converter is constructed by an interference system such as a Mach-Zehnder interferometer. Also an integrated circuit of an advanced function-integrated type is provided, comprising an interference system such as a Mach-Zehnder interferometer wherein weighting of the Mach-Zehnder interferometer is constituted for image processing and signal code conversion. A very high-speed light-receiving integrated circuit for optical communication is constructed by utilizing a very high-speed optical response characteristic of electron emission of the vacuum element, and a sensor such as a magnetic/electric field sensor is constructed by utilizing a quantum effect of ballistically traveling electrons.